Machine Learning

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Some definitions of machine learning

Computational intelligence is intended to give machines the ability to learn from what they can observe of the surrounding environment, and then act as a consequence of what they learned.
What do we mean by machine? Any man-made device or system of devices:

- Robots;
- Cars;
- Home appliances;
- The electrical grid;
- The communicatios systems;
- Medical systems;
- ...

In general, any thing that can hold a processor (computer) inside and that is wanted to be autonomous.

Some definitons of machine learning

OK, but what in the world is *learning*?

- Learning can be viewed as a process where the input consists of any available **data**, from which **information** is extracted, and then **knowledge** is inferred from this information.

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Learning machines

OK, but how a machine can learn?

- They do not take decisions from OUR knowledge.
- They learn from data, fed to them in form of numbers

Example: Construct a machine that classifies between adult men and women from measuring their height and hips diameter.

- We represent each feature in a dimension of a space.
- We construct an algorithm that learns to split the points in the space depending on their class.

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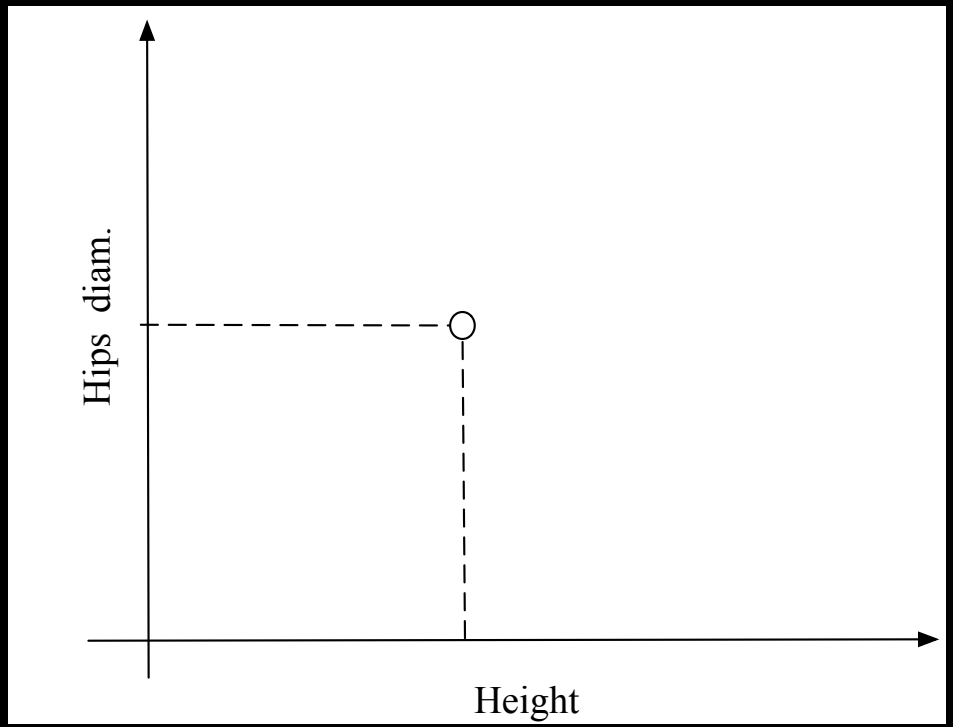
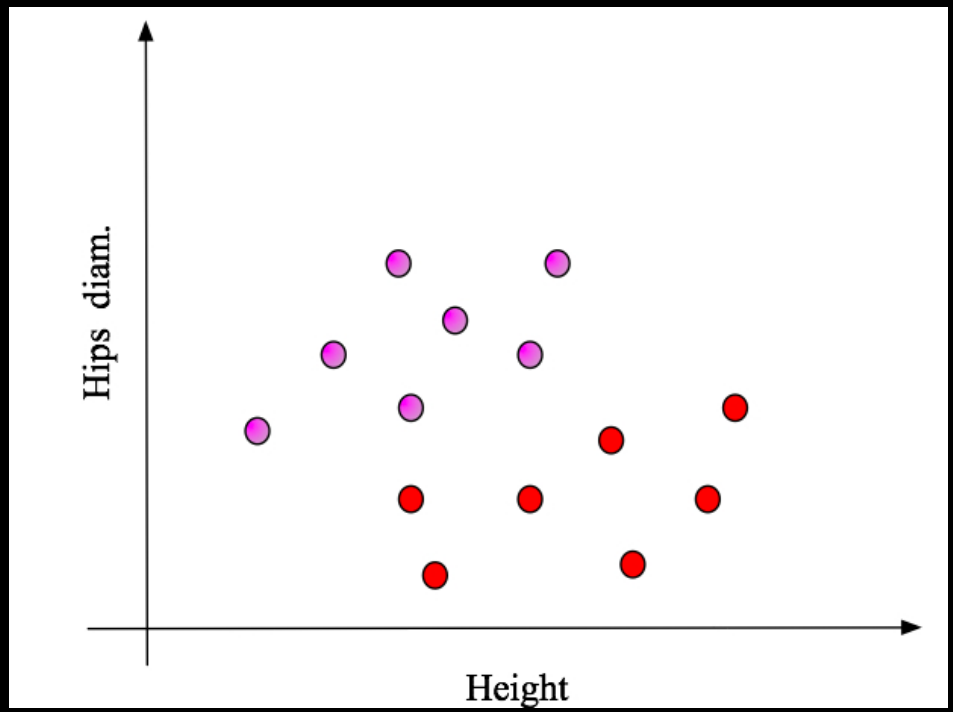
Learning machines

- We take both measures.
- We arbitrarily put hips diameter in the vertical dimension.
- We then put the height in the horizontal dimension.



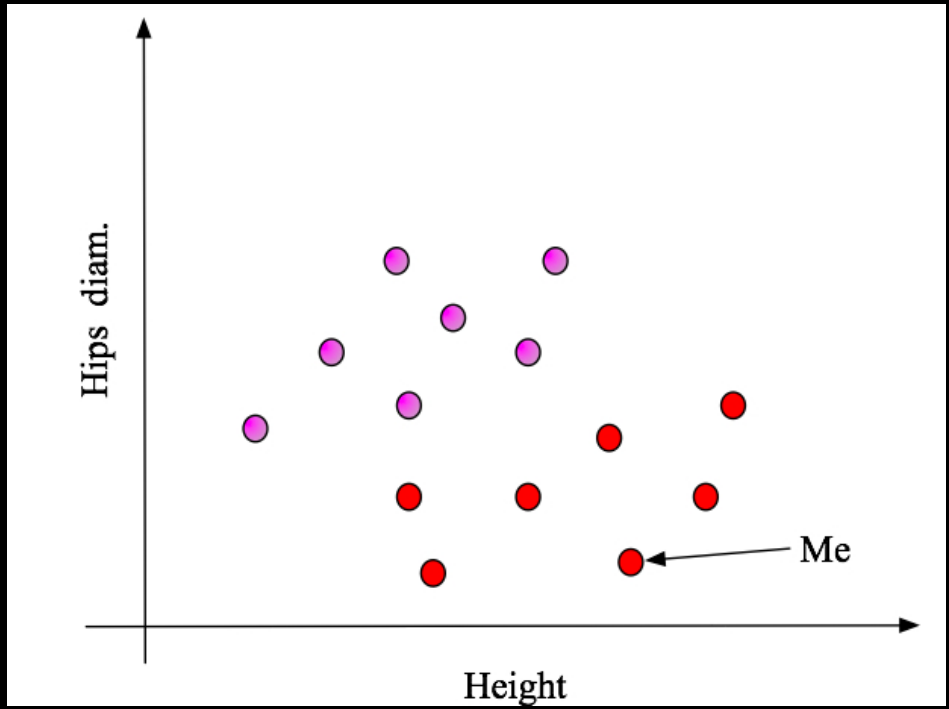
Learning machines

- We do it with as many data as we can collect.
- Since we are in two dimensions, we can se a structure in the data.
- A machine will "see" it in many dimensions.



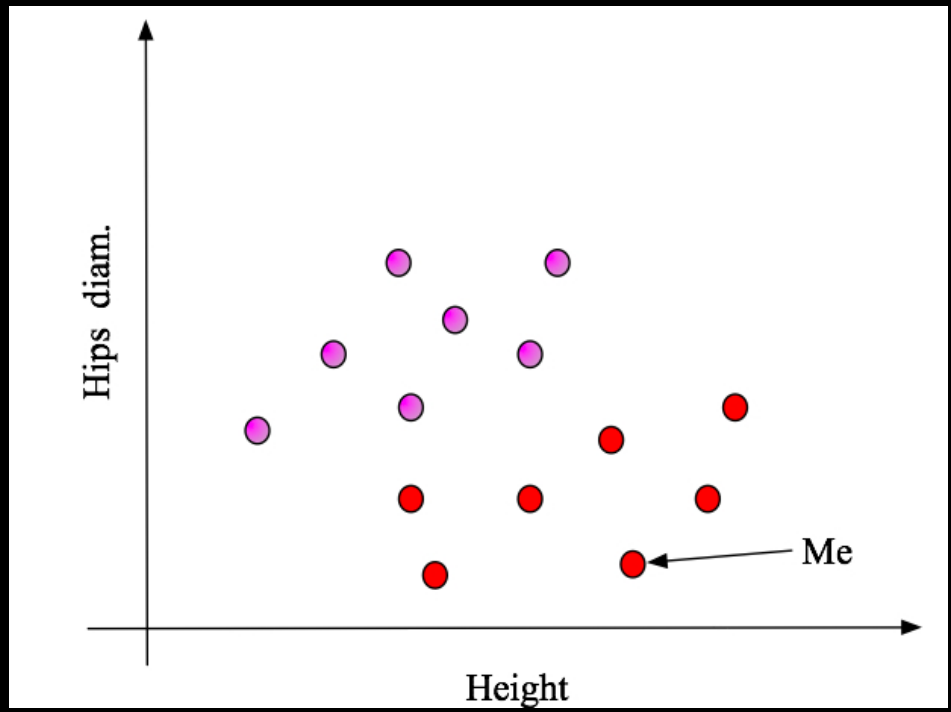
Learning machines

- These data are labelled for training.
- For us to see the structure, we put colors in this example.
- For the machine, we label the data with -1 for men (red dots)...



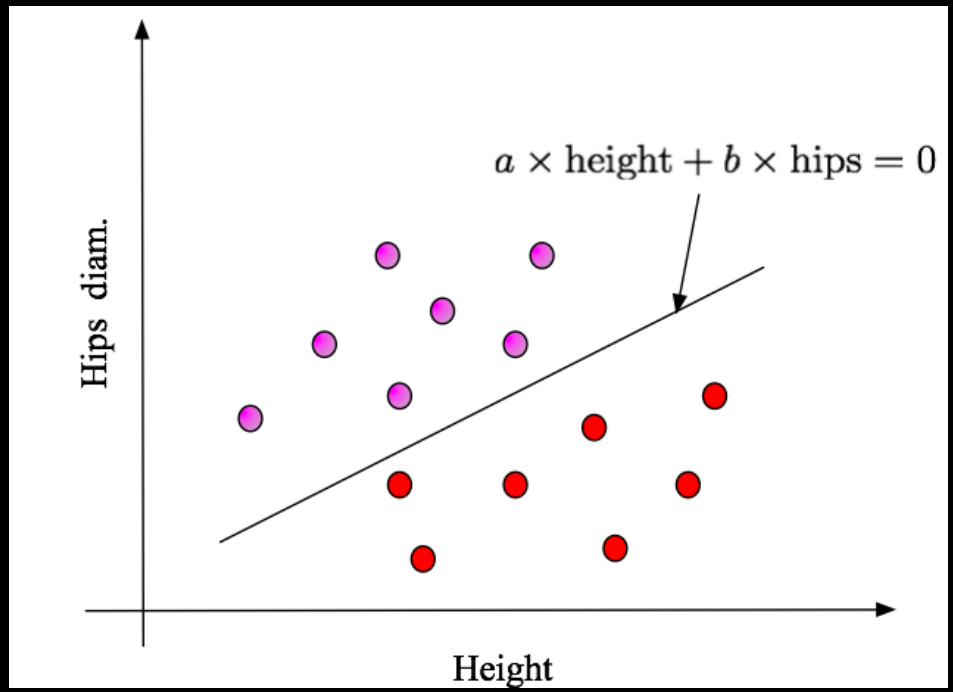
Learning machines

- ...and women are +1 (pink dots).
- this being, of course, arbitrary.



Learning machines

- The machine simply places a line separating both sets.
- Parameters a and b contain the knowledge.



- Classification
  - if $a \times height + b \times hips > 0 \rightarrow$ Woman.
  - if $a \times height + b \times hips < 0 \rightarrow$ Man.
- **Where is the knowledge here?**

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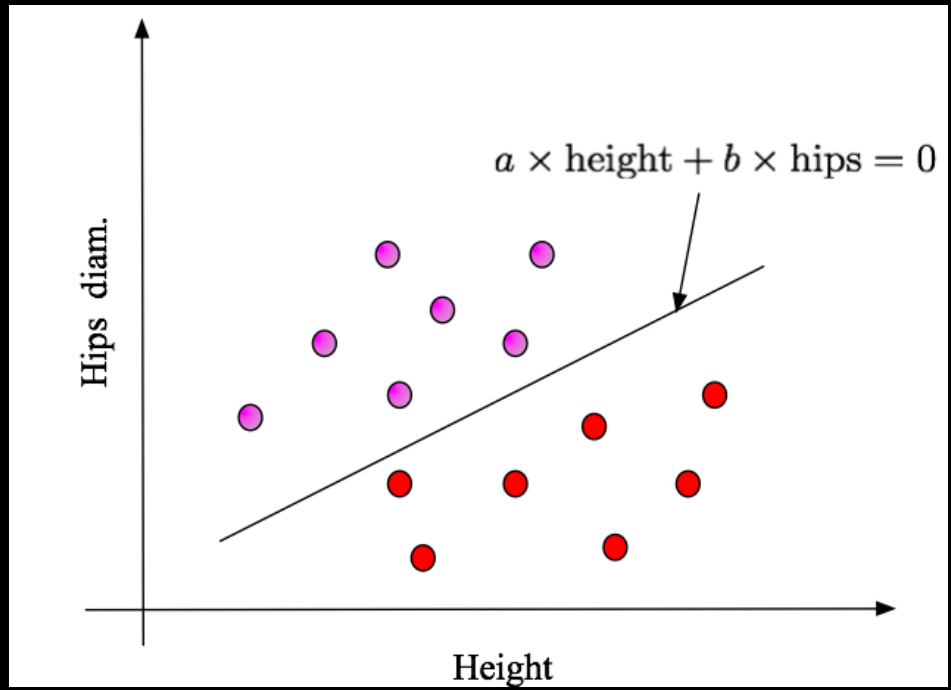

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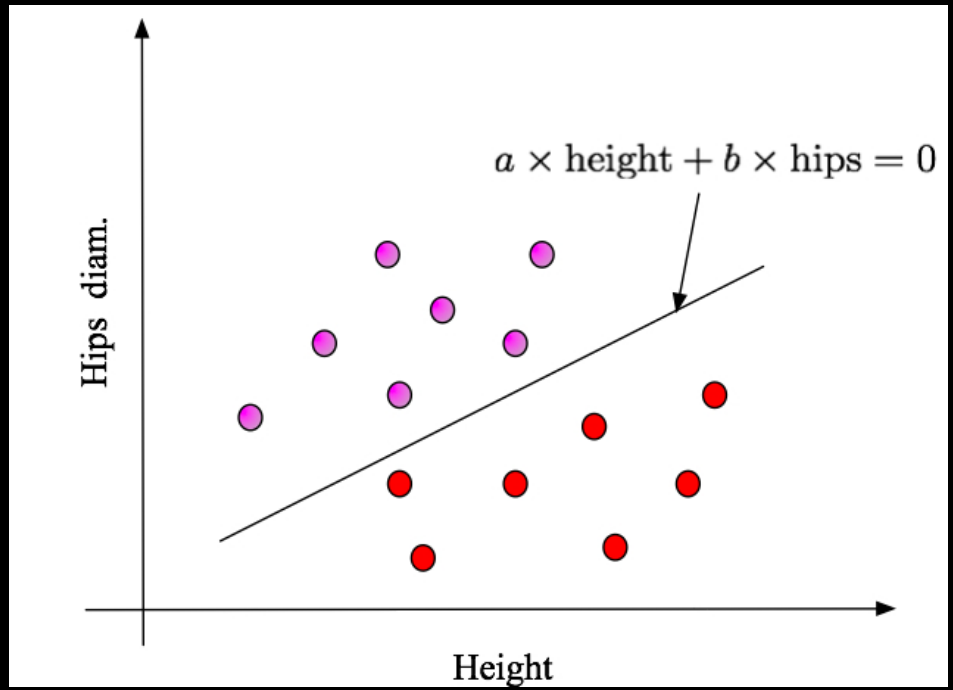

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Lesson outcomes

Main elements of this lesson:

- A definition of machine learning, with a definition of the processs data-information-knowledge.
- An example of learning machine, feature extraction, classification and associated notation.